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ALPHAEUS HYATT

ELEMENTARY ZOOLOGY.

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# University and School Extension.

## ELEMENTARY ZOOLOGY.—Course A.

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# Elementary Zoölogy.—Course A.

## PART I.

Descriptions in writing, with drawings and preserved preparations of *all* of the following animals, using Colton's "Practical Zoölogy," D. C. Heath & Co., Boston, as a guide. The "Introduction" to this work, pp. v. to xvi., gives full directions for doing the work, drawing, instruments needed, etc.

The Grasshopper, Squash-bug, Beetle, Spider, Thousand-legs, Crayfish, Earthworm, Clam, Snail, Fish, Frog, Snake, Turtle, Pigeon, Rabbit, or a Rat.

The above is intended as an introduction to the more minute work of the next, or second part of the Course, and the directions given immediately below, under Part II., must be observed in so far as they apply to methods.

## PART II.

Description in writing, with drawings of the external characters and gross anatomy of the parts and organs of *one* or *more* of the animals named in the list below. The animal or animals selected, if practicable, should be known to live in the immediate vicinity, and the mode of occurrence and habits should be studied by the students, both in the field and with the aid of books. The student himself should not only collect, but also study while collecting, so as to gain accurate ideas of how the animal lives and moves, the uses of its parts and organs, and its relations to other organisms in the same

locality, and to its inanimate surroundings. The object of this course is to introduce the student to good models and reliable guides for preliminary zoölogical work, and therefore only those subjects most likely to produce good results, if pursued without a teacher, and without knowledge of the use of the compound microscope, have been chosen. If the student select a domesticated animal, or one that he cannot study in the field, he will be required to take in addition some allied species which occurs in his vicinity, and make himself familiar with its habits. Subjects included in brackets are to be studied together and in succession, as mentioned below. The drawings should be accurate, but should not be shaded, and artistic merit is not important. Every drawing should be lettered and fully described, and correspond with some particular preparation. When copied from books, or drawings made by others than the students, they will not be accepted. The student is also required not to finish them from memory, but on the spot, and then to leave them without any attempt at subsequent improvement, unless in presence of the same or a duplicate preparation. It will, however, be found essential for the student to practise drawing from memory, so that he may be able to illustrate examination papers.

A series of his own preparations preserved in alcohol, strong brine, or Goadby's solution, will be demanded at examinations, and the student will be required to demonstrate his familiarity with these and his ability to draw them in outline.

The following is the list from which selections may be made :

Crayfish : Huxley and Martin's "Biology," by Howes & Scott ; ed. 1888, pp. 173–231. Macmillan, New York.

Lobster: Huxley and Martin, as above, and Hyatt's "Worms and Crustacea," Science Guides, No. VIII., pp. 17–47. D. C. Heath & Co., Boston.

Crab: Brooks' Handbook of Invertebrate Zoölogy," pp. 168–185, 190–206. S. E. Cassino, Boston.

Earthworm: * Brooks, as above, pp. 140–159; Huxley and Martin, as above, pp. 240–264; and Sedgwick and Wilson's "Biology," pp. 186, 117–141. Henry Holt & Co., New York.

Leech: Brooks, as above.

Grasshopper: Brooks, as above, pp. 237–269, and Packard's "Zoölogy," pp. 307–329.

Cockroach: Miall and Denny's "Struct. and Life Hist. of Cockroach," Lovell, Reeve & Co., London, pp. 32, 35–47, 57–63, 68–70, are a few quotations from the descriptions of the gross anatomy, which will serve to guide the student in making selections from the text.

Clam (fresh-water): † Brooks, as above, pp. 269–311, or Huxley and Martin, as above, pp. 305–341.

Clam (marine): Brooks, as above, pp. 269–311, and Hyatt's "Mollusca," as above, Science Guides, No. VI., pp. 37–43.

Oyster: Brooks, as above, and Hyatt, as above, No. VI. pp. 5–36.

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* The worms are really difficult subjects, and should be selected only after a student has had some experience in the use of dissecting instruments and methods.

† The care and judgment required in killing clams is a considerable part of the work, as it is in all soft-bodied animals, and the student must not be discouraged if he do not succeed in many of his first attempts. Only the closest observance of the directions given and the acquired experience of several failures will enable him to overcome all difficulties.

Starfish : Brooks, as above, pp. 56–72, and read also pp. 73–83, and verify as far as practicable the section drawn on p. 74.

Sea-urchin : Brooks, as above, pp. 83–98, and for homologies, Hyatt's "Hydroids, Corals, and Echinoderms," Science Guides, No. V., pp. 23–39.

Codfish, Haddock, or Pollock : Parker's "Zoötomy," pp. 86–130. Macmillan.

Cunner (marine), may be substituted for Codfish, etc., by using Packard's "Zoölogy," pp. 434–442.

Lamprey : Parker, as above.

Skate : Parker, as above.

Frog : Huxley and Martin, as above, pp. 1–121.

Lizard : Parker, as above, pp. 130–181.

Snake may be substituted for Lizard by using Parker, as above, and also Packard's "Zoölogy," pp. 496–500.

Terrapin : Martin and Moale's "Handbook of Vertebrate Dissection," Pt. I. Macmillan. "How to Dissect a Chelonian," pp. 6–88.

Any species of Turtle may be substituted for the Terrapin by using Packard's "Zoölogy" in connection with the above.

Pigeon : Parker, as above, pp. 182–262, or Martin and Moale, as above, Pt. II. Macmillan, New York.

Rabbit : Parker, as above, pp. 262–379.

Rat : may be substituted for the Rabbit by using Martin and Moale, as above, Pt. III., or Cat, Wilder and Gage, "Anatomical Technology." A. S. Barnes, New York. Chapters V.–IX.

# PART III.

A collection, or studies of allied forms of the same group as the animal selected for dissection, should also be undertaken wherever practicable, and excursions for these purposes should be frequently made. Suitable guides for collecting, etc., will be recommended after subjects have been selected. A diary of these excursions and of observations made must be kept in such a form that it can be handed in at examinations. In case such work is not practicable, studies and observations in some museum or collection may be substituted, and in that case the work will have to be done by making drawings of the animals studied, and keeping a daily record of observations.

## Remarks.

Parts I. and III. of this Course may be carried on together, or Parts II. and III., but not Parts I. and II., which should be taken in sequence.

Instruments needed are as follows: Two or three dissecting knives of various sizes, those with pointed cutting-tips being the best; two pairs scissors, one small and one medium size—the smallest should have bent blades, this form being better for general use; a small German-silver blowpipe or glass tube, drawn out and bent with open tip; a medicine-dropper of glass (the blowpipe will be found very useful in lifting delicate membranes, etc., and the dropper to clean specimens); a piece of pliable wire with rounded end; two pairs of forceps, one small and one medium size; several needles set into

wooden handles, to be used in tearing or separating minute parts. A common magnifier with three lenses, and for some dissections a jeweller's lens with a wire to fit the head, or a small dissecting microscope, will be found convenient.

Almost all dissections are best performed under water, and the object should be stretched out and pinned down, in order to facilitate examination and cutting. Any dish of appropriate size and depth can be used, and tablets for stretching can be made from sheet cork, which may be loaded with sheet lead. It is advisable to have several sizes of these sheets made to suit the dishes used, and they should all be coated above with paraffine or wax colored with lamp-black, so as to give a dark, smooth surface.

Advice with regard to the best modes of treating animals can be found in Huxley and Martin's "Practical Biology," Parker's "Zoötomy," Brooks' "Handbook of Invertebrate Zoölogy," and Wilder and Gage's "Anatomical Technology."

## MICROSCOPE.

Persons having the means are recommended to purchase a compound microscope and practise the use of this instrument in preparation for more advanced studies in zoölogy.

General directions and a knowledge of the instrument may be obtained from "How to Work with a Microscope," by Beale, 5th ed., Lindsay & Blakiston, Philadelphia; "The Microscope and its Revelations," by Carpenter, 5th ed., Churchill, London; "Naturalist's Assistant," by Kingsley, Cassino, Boston; "Notes on Microscopical Methods," by Simon H. Gage, Andrus & Church, Ithaca, N. Y. A

student's or laboratory microscope and four objectives—a three-inch, one-inch,* one-half-inch, and one-quarter-inch *—form an excellent equipment. It may be necessary or advisable in some cases to exercise economy, and then the student can get along with the objectives marked with a star, though, of course, this increases the difficulty of his work.

Instruction in the manner of handling and preparing animals for the microscope may be obtained from "Microtomist's Vade Mecum," by Arthur Bolles Lee, London, J. & A. Churchill, 1885; "Methods of Research in Microscopical Anatomy," by Whitman; "Naturalist's Assistant," and other books as mentioned above, and also "Anatomical Manipulation," Tulk & Henfrey, 1844, Van Voorst, London; "Notes on Histological Methods," 1885–'86, by Simon H. Gage, Andrus & Church, Ithaca, N. Y. A list of publications on the use of the microscope is given in the "Histological Methods," by Gage, p. 50.

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NOTE.—A more advanced course will be prepared in case there is a demand on the part of students who have passed satisfactory examinations.

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